



Cognitive and Behavioral Sciences at the Office of Naval Research

Robert S. Bolia
Associate Director
ONR Global
Tokyo, Japan

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE SEP 2010		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Cognitive and Behavioral Sciences at the Office of Naval Research				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ONR Global Tokyo, Japan				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES See also ADA560467. Indo-US Science and Technology Round Table Meeting (4th Annual) - Power Energy and Cognitive Science Held in Bangalore, India on September 21-23, 2010. U.S. Government or Federal Purpose Rights License					
14. ABSTRACT With one of its six research departments focused on enhancing the performance of US Navy and Marine Corps personnel, the Office of Naval Research (ONR) has invested considerably in the cognitive and behavioral sciences. A significant portion of this investment has been in basic and applied research in human cognition, designed to understand the human operator's cognitive capabilities in order to better support individual and team decision making in complex environments. This research, most of which is carried out at universities, will ultimately inform the design of human-machine interfaces such as spatio-temporal situation displays, decision support systems, and collaboration tools. This presentation will discuss relevant ONR programs in the cognitive and behavioral sciences, as well as provide an overview of ONR Global and the tools available to support collaboration between Indian researchers and the US Naval Research Enterprise.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 17	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

US Naval Research: A Brief History



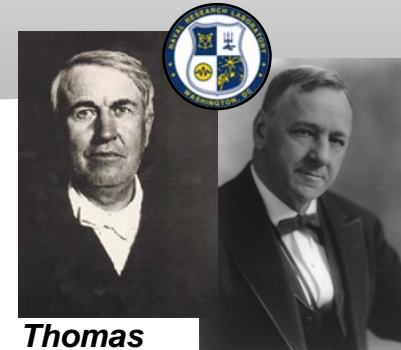
Naval Research Laboratory (1916)

- "[Conduct] exploratory and research work...necessary... for the benefit of Government service, including the construction, equipment, and operation of a laboratory...."



**Vannevar
Bush**

**Harry S
Truman**



**Thomas
Edison**

**Josephus
Daniels**

Office of Naval Research (1946)

- "... plan, foster, and encourage scientific research in recognition of its paramount importance..."

Nobel prize winner, Dr. William Philips, NIST

Laser cooling and trapping of atoms

Prof. Leon Chua, UC Berkeley

Memresistor

Prof. Anthony Brennan, University of Florida

Biomimetic technology that mimics shark's skin for antifouling

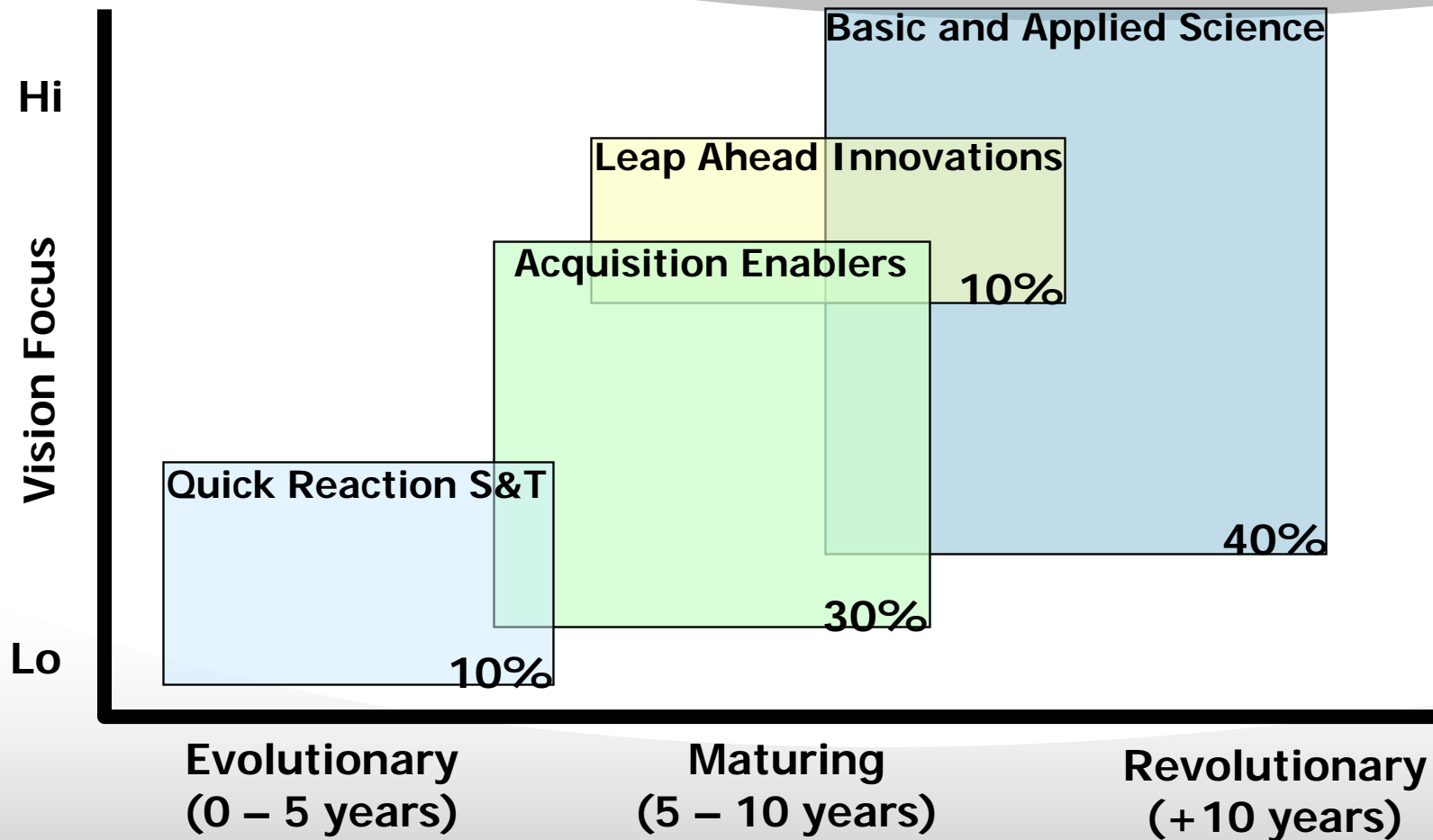
Nanosys, Palo Alto, CA

Bandage that stops bleeding 40% faster than conventional gauze

Quantum Health Innovations

Gryphon™ Infectious Disease Simulator that allows users to simulate a disease outbreak

ONR S&T Portfolio Balance



Human Performance & Protection



Bio-medical Science and Technology

- Battlefield combat death reduction ... Under investigation are blast, thermal, hemorrhagic shock, and traumatic brain injury
- Endemic, exotic and genetically modified pathogen protection
- Non-lethal weapons bio-effects - high power microwaves, underwater active denial systems, and directed energy
- Understand resilience to operational (fear, anxiety, ambiguity, and sleep deprivation) and environmental stressors
- Identify and exploit design principles evolved in Nature to enable new processes, sensors, or materials

Undersea Medicine

- Mechanisms of gas action in living tissue
- Hyperbaric oxygen toxicity and predictive/prophylactic methods
- Decompression sickness and arterial gas embolism
- Improve diver and submariner health and performance

Human Systems Science and Technology

- Social, cultural, and behavioral modeling to counter terrorism
- Creation of human behavior modeling techniques that reduce the cost of computational models of human behavior
- Develop more powerful integrative theories of human learning and instructional strategies
- Develop models of cognitive architecture to assist in managing attention in multimodal workstation
- Understand the cognitive processes underlying team collaboration and decision making

Information Analysis & Decision Support



Automated Image Understanding

- Fully automated segmentation and parsing of images
- Recognition of objects and their activities and inferring their intentions
- Tracking multiple objects under occlusion
- Fast/reliable algorithms with high detection rates & low false positives

Information Processing/Discovery/Integration/Presentation

- Methods and tools to manage data from multiple sensors and sources
- Exploiting non-traditional data types, such as free-form text, as sources of information in decision tools
- Tools to turn data into information that is relevant to the operator
- Decision-making methods and tools that optimize use of scarce and/or expensive resources

Computational Analysis ... Analytical and computational tools to apply to complex problems

- Meteorology and ocean dynamics
- Simulation of underwater explosions
- Simulation of micro-fluidics and nano-structures
- The inverse problems that arise from acoustic and electromagnetic wave propagation

Challenges in Cognitive Science for Naval Applications

- Training and Education S&T
 - Past & Current: Intelligent tutoring systems
 - Past & Current: Instructional strategies
 - Past & Current: Affordable behavior models for simulation-based training
 - *New: Synthetic teammates via high-fidelity computational cognitive models for team-based training*
- Human-Machine Interfaces
 - Past & Current: Cognitive models of warfighter decision-making for complex tasks (e.g. TADMUS)
 - *New: Richer cognitive models of warfighter decision-making in attentionally demanding multitasking situations (e.g. CIC watchstanding, UxV operation).*
- Intelligent Autonomy
 - Past & Current: UxVs almost entirely tele-operated
 - Past & Current: Human/UxV interaction via cumbersome, attentionally-demanding interfaces
 - *New: Toward Human-Level Competence for UxV's*
 - Robust natural language understanding grounded in cognitive architecture
 - Mechanisms in cognitive architectures to support both linguistic and non-linguistic social interaction – e.g. activity/intention recognition.
 - New inferential backbones for cognitive architectures supporting the integration of probabilistic, possibilistic and relational reasoning techniques.
 - Large-scale knowledge-bases/memories, extended operation in unconstrained/dynamic environments under conditions of both ignorance and uncertainty.

Infantry Immersion Trainer

- Purpose: Emphasize the Human Dimension of Warfare
 - Eliminate Steep Learning Curve In Combat
 - First Fire Fight No Worse Than Last Simulation
 - Inoculate Soldiers & Marines With Sights, Sounds, Smells, & Chaos of close quarters battle
 - Integrate essential skills:
 - Joint Operational Capabilities Tasks
 - Combat Hunter/Profiling
 - IED detection, disruption, and defeat
- Endstate:
 - Decision making focus, sensory overload, open-ended objectives
 - Individual and small unit self-confidence
 - Distributed, reconfigurable, multi scenario, combined arms
 - Ground based simulation on par with aviation simulation.

Contact Info

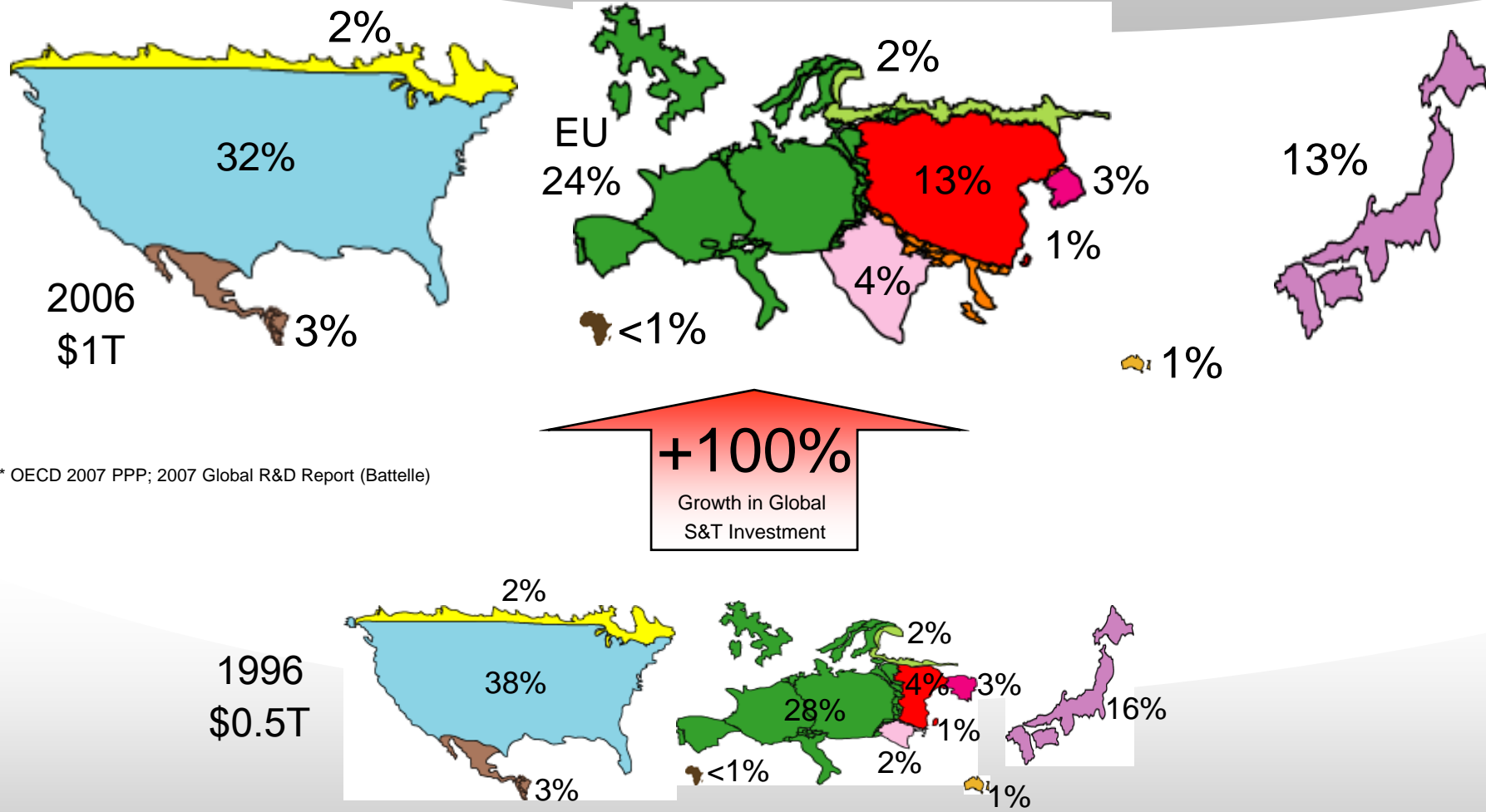


Robert S. Bolia

Robert.Bolia@onrg.navy.mil

World S+T Investment Dynamics

100% Global S&T Investment Growth in a Decade



** OECD 2007 PPP; 2007 Global R&D Report (Battelle)

* UIS S&T database; World Bank - PPP data

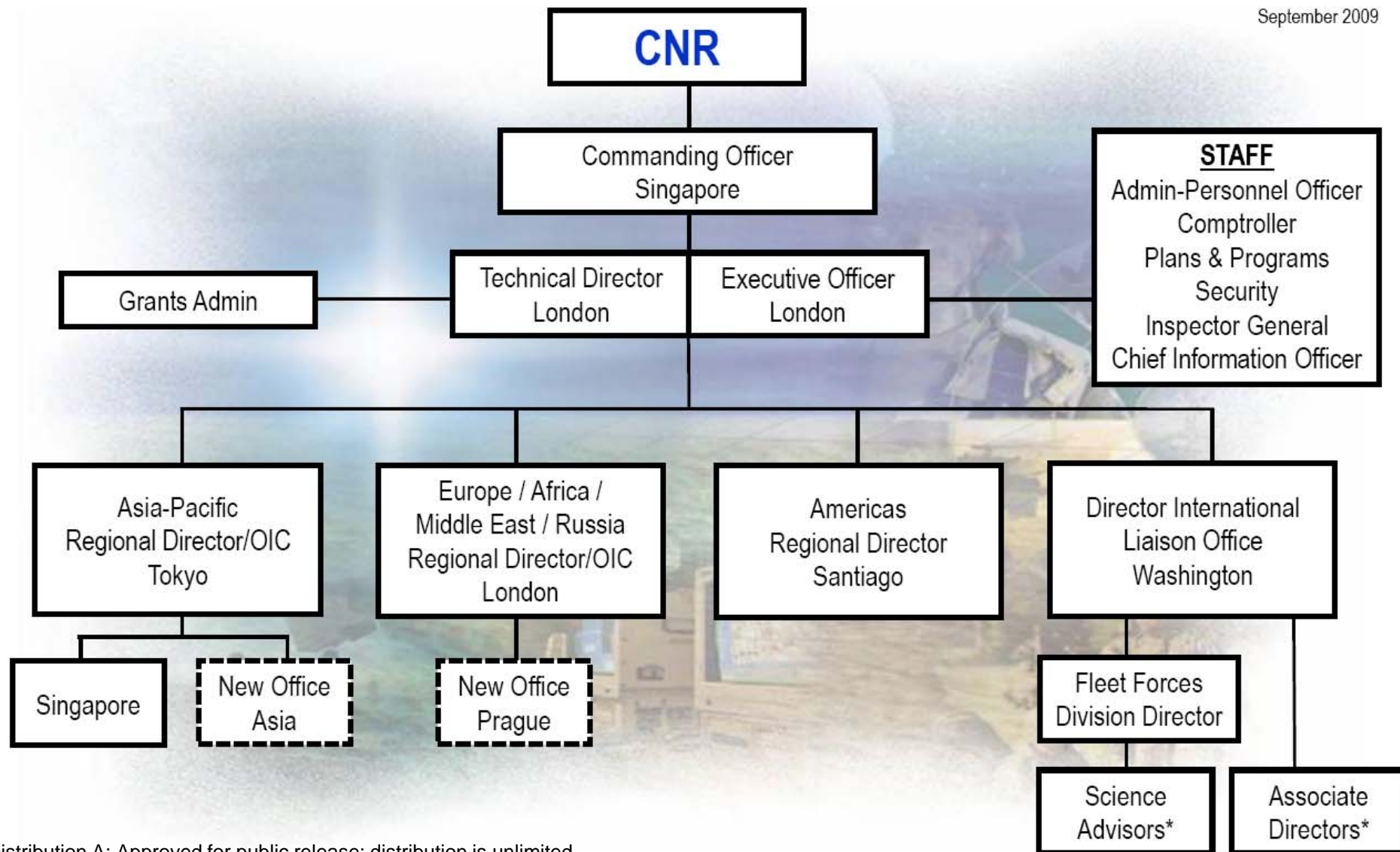
ONR Global Mission Statement



To search the globe for promising, emerging scientific research and advanced technologies to enable the Office of Naval Research to effectively address current needs of the Fleet and Force and to investigate and assess revolutionary, high-payoff technologies for future Naval missions and capabilities.

ONRG Organizational Chart

September 2009



ONR-Global Science Program Tools



Conference Support Program (CSP)

- Support foreign or international workshops and conferences of Naval interest

Liaison Visits

- ONRG technical staff visit international institutions to develop access and discover cutting edge S&T

Visiting Scientist Program (VSP)

- Support travel of foreign scientists to the US to socialize new S&T ideas or findings with the NRE

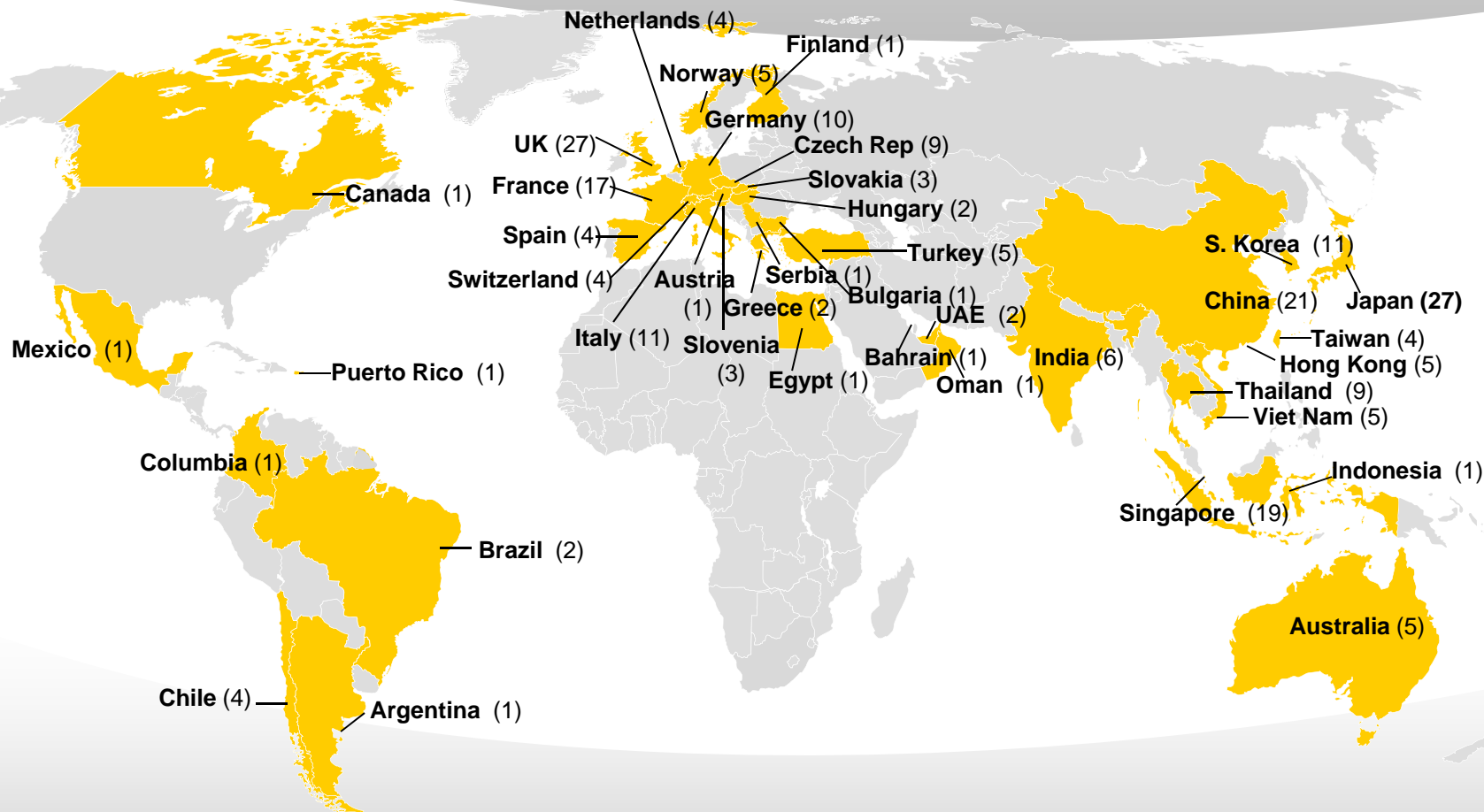
Naval International Cooperative Opportunities Programs (NICOP)

- Support the insertion of innovative, international S&T into core ONR and NRE Programs

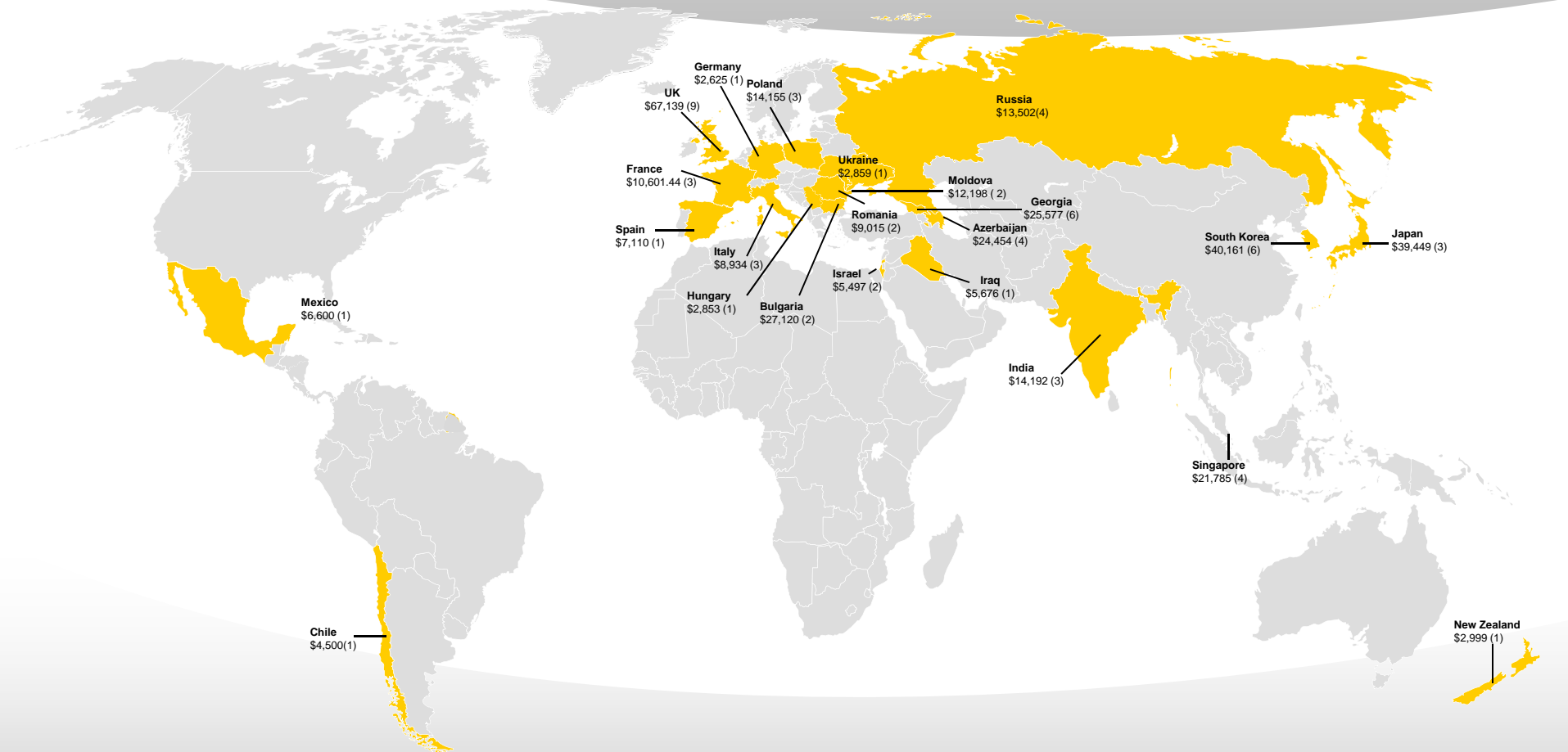


Small invests early leads to significant results

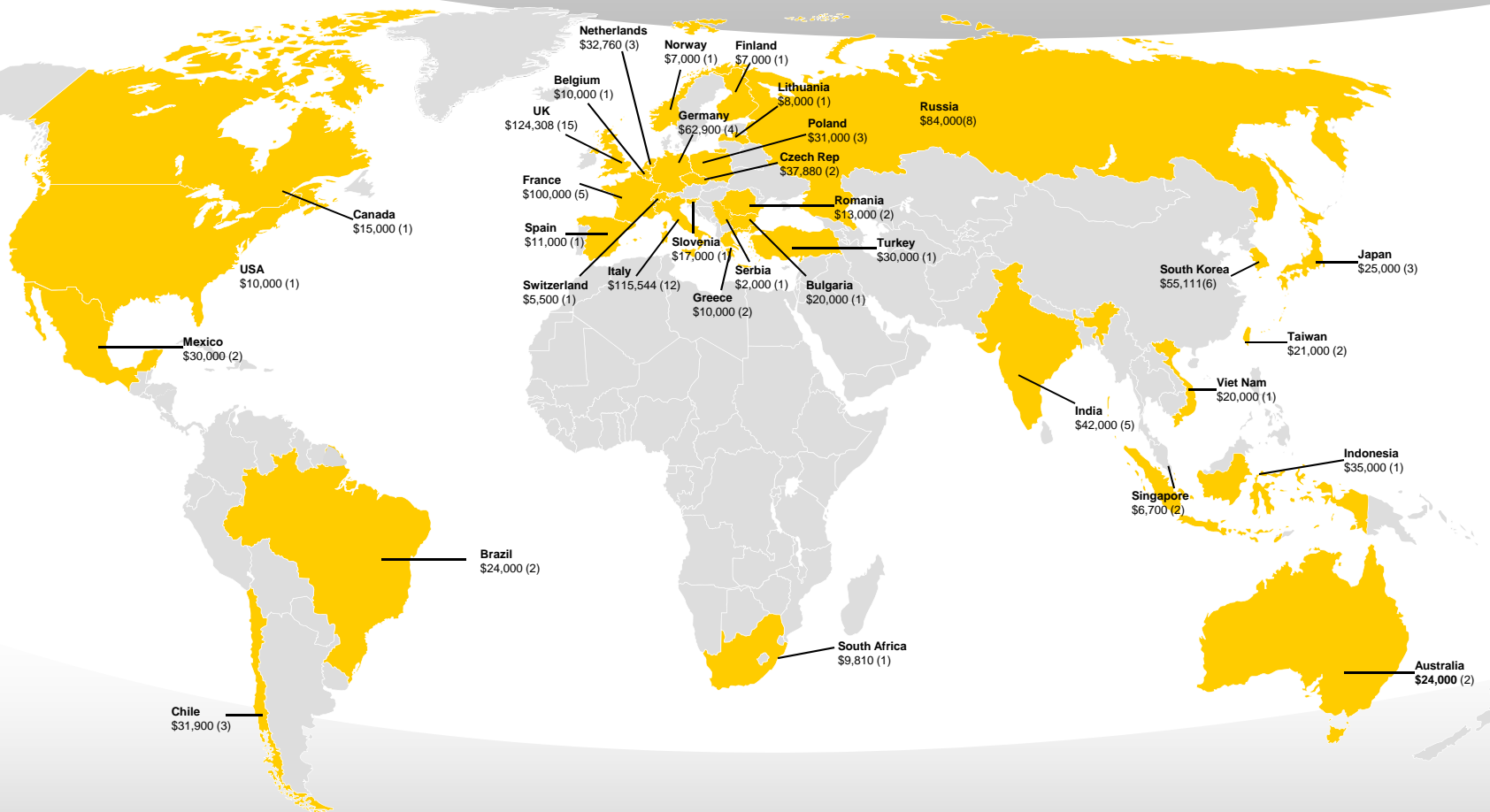
FY09 Liaison Visits



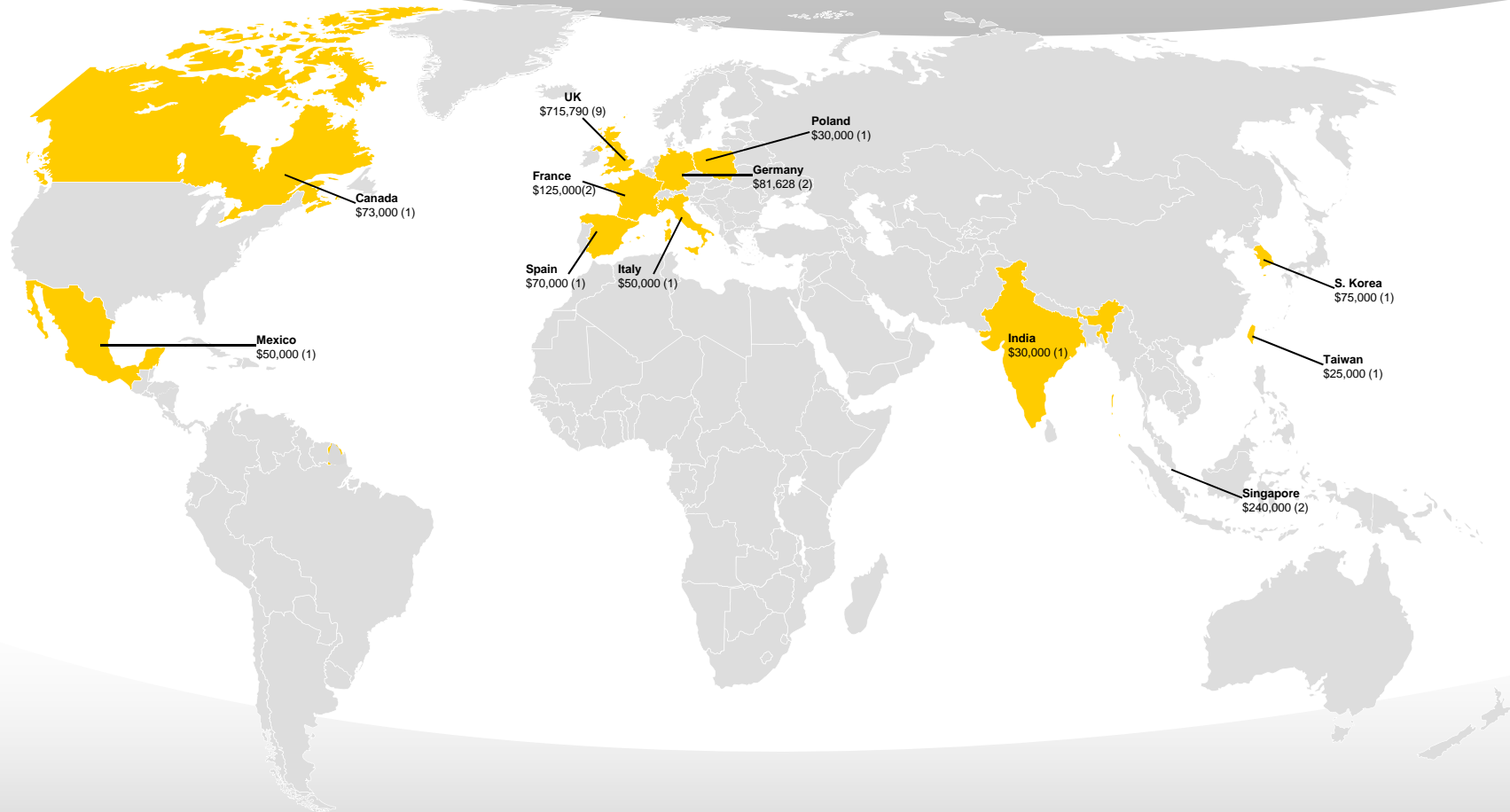
FY09 Visiting Scientist Program



FY09 Conference Support Program



FY09 NICOP Grants



Conferences Supported in India



- IEEE Workshop on Spoken Language Technology (Goa, December 2008)
- Third Workshop on Intelligent Networks (Bangalore, January 2009)
- 3rd Indo-US S&T Roundtable (Bangalore, March 2009)
- 7th International Conference on the Beginnings of the Use of Metals and Alloys (Bangalore, September 2009)
- International Conference on Electroceramics (New Delhi, December 2009)
- XV International Workshop on the Physics of Semiconductor Devices (New Delhi, December 2009)
- International Workshop and Conference on Engineering and Marine Applications (Pune, January 2010)
- Indo-US Workshop on Shallow Water Acoustics (Goa, February 2010)
- 3rd US-Indo Frontiers of Engineering (New Delhi, March 2010)
- 14th Pacific-Asia Conference on Knowledge Discovery and Data Mining (Hyderabad, June 2010)
- 4th Indo-US S&T Roundtable (Bangalore, September 2010)
- International Conference on Fiber Optics and Photonics (Guwahati, December 2010)